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MODERN STUDIES OF BACTERIAL GENETICS

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## SEVERAL PROBLEMS OF THE GENETICS OF THE PLAGUE MICROBE IN THE LIGHT OF MODERN STUDIES OF BACTERIAL GENETICS

[Following is the translation of an article by I. L. Martinevsky, published in the Russian-language periodical Materialy nauchnoy konferentsii po prirodnoy ochagovosti i profilaktike chumy (Materials of the Scientific Conference on the Natural Focality and Prophylaxis of Plague), Feb 1963, Alma Ata. Translation performed by Sp/7 Charles T. Ostertag, Jr.]

At the present time there is great interest in the study of microbial genetics, with the help of which both general biological problems as well as several problems of microbiology, epidemiology and the prophylaxis of infectious diseases are being resolved. The genetics of microbes of the enteric group have been studied in most detail, in particular the K12 strain of the enteric bacillus isolated from man 40 years ago. Many problems of genetics of the plague microbe have been studied very insufficiently. There is great interest in the study of such problems as the systematic position of the microorganism, species forming mutability, lysogenesis, transduction, transformation, auxotrophism, recombination, adaptation mutability and dissociation.

Based on Bergey's latest classification (1957) the plague and pseudotuberculosis microbes belong to the family Brucellaceae, which is apparently incorrect. The presence in the pseudotuberculosis and plague microbes of phages (Druzhinina and coauthors, 1960; Smith and Burrows, 1962), pesticin and colicin (Smith and Burrows, 1962) receptor sites which are common with the intestinal and several species of dysenteric and typhoid bacilli testifies to the similarity of the plague and pseudotuberculosis microbes with bacteria from the family Enterobacteriaceae. We were able to establish an antigenic similarity of the plague microbe with several strains of enteric bacilli isolated from large gerbils, based on the Ochtolony cross reaction in gel. We propose that it will be correct to relate the plague and pseudotuberculosis microbes to the family Enterobacteriaceae.

In our country, for the first time, the fact was established of the transition of the plague microbe into pseudotuberculosis on nutrient media (Lenskaya, 1936 and others) and in the organism of animals (Tumanskiy, 1943 and others). However, these facts of species formation are not faultless in the sense that the experiments were not conducted with clone cultures.

According to the works of Smith (1961), lysogenesis is absent in the plague microbe. There is great interest in the search for lysogenic strains of the plague microbe by a different method and in a greater number of strains. In the event that a temperate phage is detected, it is necessary to carry out

tests on the study of transduction in the plague microbe. As the basis for these tests, it is possible to take the works of Freeman (1951), Freeman and Morris (1952), and Barksdale (1958), which were carried out on the transduction of virulence in diphtheritic bacilli. Such works may render significant help in clearing up the nature of virulence in the plague microbe. As is known, Burrows (1962) distinguishes four determinants of virulence: The ability to produce the antigens F1 and VW (F1 +, VW +); the ability to yield pigmented growth on a medium with hemin (P+); the ability to independently synthesize purine (Pu+). Along with this, the author also considers the problem of a possible existence of a virulence gene T+ and the transfer of features with the help of phage transforming DNA.

Transformation is the most difficult and complex division of microbial genetics. The only work dealing with the transformation of certain features of the plague microbe into pseudotuberculosis with the help of DNA is the work by Arkhangelskaya and Terentyeva (1961). However, the author was not able to obtain conclusive proof of the possibility of the plague microbe gaining new features with the help of preparations of DNA. However, the further study of the phenomena of transformation is necessary, paying attention to the conditions which may be favorable for the transmission of hereditary information with the help of DNA. It is possible that here the physical-chemical condition of the microbial wall has a very great importance.

Recombination and the auxotrophic characteristics of the plague microbe have not been studied at all. For the realization of recombination it is necessary to isolate more dependent auxotrophic mutants. From two avirulent strains of the plague microbe Burrows and Bacon (1954) isolated mutants which were dependent on tryptophan, arginine, adenine and nicotinamide. It must be noted that under natural conditions various strains may exist, whose growth may depend on other organic compounds which are not encountered in the basic minimal medium for the growth of the plague microbe. When studying 250 strains of the plague microbe, we together with Osadchay (1963), isolated 18 cultures which did not grow without the addition to the basic medium of leucine (9-strains), arginine (7) and guanine (2 strains). Therefore, with several strains it was already possible to proceed with the study of recombination. There is particular interest in the recombination analysis of the cohesion ability of features with the gene of glycerin +, for example, with virulence and auxotrophic ability.

In regards to the adaptation of the plague microbe, it is necessary to repeat the experiments of Rayan and Khinshelvud (1953), who conducted tests with the enteric bacillus. On glycerin and glycerinless media, according to these tests, it is possible to resolve the nature of the enzyme which is responsible for the glycerin-positive feature, with which a whole number of properties of the plague microbe are connected.

In regards to dissociation in the plague microbe, this problem has been well treated in native literature.